ties of the small intestines for the purpose of determining which was the afferent and which was efferent end of the tube, so as to make the invagination in the right direction, a procedure which often required considerable time, and brought additional risk by increasing the shock of the operation and the danger of traumatic infection.

[TO BE CONTINUED].

ERASION OF THE KNEE JOINT.

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THE operation known as erasion or arthrectomy of the knee joint, can scarely yet be said to have attained its full significance, or become so developed and perfected as to claim the title of an universally recognized and adopted surgical procedure. It is true that many operators have performed it, yet the published accounts of their methods, and especially of the ultimate results obtained, are by no means numerous in comparison with the number of cases in which the operation seems to have been adopted. Hopes may be entertained, however, that this will be altered, and the next few years find the literature of this operation more explicit, and the methods of its performance more generally and better understood. I do not propose to enter into the question of priority of invention of this operation. Such matters are difficult to solve with justice, and the study is an unprofitable one. We may readily understand how the necessity for operations of this kind has gradually arisen. The result of formal excisions of the knee were not such as to satisfy individual operators. A large number of excisions were undertaken for cases of synovial disease where the bones, if at all implicated, were quite superficially affected. The removal of slices of bone and impairment of proper growth which ensued in consequence seemed unsatisfactory. Soon less extensive operations began to be devised. Most of these seemed to err on the side of insufficient removal of disease. Some surgeons attempted the extirpation of the diseased membrane by the action of strong acids—others attempted its removal by having recourse to the use of a sharp spoon or curette introduced into the joint through openings or sinuses. Some of these operations were dignified by such titles as partial excision, and indeed it is a matter of some difficulty to definitely decide as to what is meant by the term "erasion" of a joint, and to what class of cases the operation is to be restricted. So far as I can understand, an ideal operation for erasion of the knee joint would consist, broadly speaking, of opening the joint by such incisions as render free access to every part of its interior. Every fragment of unhealthy synovial tissue must be carefully removed. Diseased cartilage is to be pared away and any carious bone removed with a gouge. After this the limb is fixed upon a splint, and the bone ends sutured or not, according to the fancy of the operator.

It is obvious that if the bone ends are much diseased, the removal of this will bring the case into the category of excision. And it must sometimes happen that when a joint is opened more disease is found than was at first suspected. If in such a case the operator holds to his original intention of erasion, he will probably fail to remove all the mischief and the case will do badly. Doubtless the reader will remember that in a considerable number of cases "movable" joints are declared to result. He will, with justice exclaim that recovery with a freely movable joint would be out of the question, were such extensive operative proceedings carried out on the ligaments and articular surfaces of the bones. But here I must candidly confess my inability to strictly define what case, or class of cases is suitable for such operative measures as would remove serious disease from joint structures, and yet leave them in such a condition as not to impair their integrity or diminish their future usefulness. I must not say that such cases do not occur, for surgeons of repute state that they have experienced them. I have been informed privately by more than one operator, that they have been both pleased and surprised at the movements remaining in a knee joint after erasion.

Individual experience of this operation and its results must generally be limited. This may serve as an apology for the fact that I have never seen a case of a freely movable joint, in the sense of flexion and extension after the operation of erasion. I have, indeed, examined more than one case where this success was claimed. Movement in these undoubtedly occurred, but as the subjects constantly wore posterior splints to prevent permanent contractures, it is difficult to understand how the results could be considered more advantageous to them than bony ankylosis. Chronic flexion is only too apt to occur after all operations upon the knee joint. Practical surgeons know how difficult it is to combat, and how, especially among the poor, it may supervene many months after the discharge of the patient from the hospital, and spoil the best operative effects. A very considerable time must elapse before an operator can assert that a case of excision or erasion of the knee is thoroughly successful. I am, of course, now speaking entirely of cases of extensive operation, as erasion of the knee joint. We have all witnessed cases of complete restoration of normal movement in knee joints, the seat of purulent synovitis, which has been promptly drained, under strict antisepsis. But in these cases the joint structures are left largely intact. They cannot be compared to instances where synovial membranes, cartilages and ligaments, are cut or scraped away in their entirety. So far as my own observation and experience will allow me to pronounce upon this difficult and debatable point, mobility should only be aimed at in cases where the joint surfaces, and especially the crucial ligaments are left intact. Thus the list must be a limited one.

I cannot but regard many of the untoward results that have followed the operation of erasion of the knee as due to creditable, but ill-advised attempts at the restoration of movement in joints disorganized beyond hope of repair, either by disease or the operative methods required for its removal.

Let us now glance at the published accounts of the operation. Our leading text books do not mention it. One of the most recent writers on joint affections, though he refers to the drainage of joints, and speaks more markedly than many authors of the disadvantages which attend excision, yet makes no mention of the process of erasion as a formal operation. He hints at it, however. "When the joint is the seat of tedious suppuration it may be opened by free lateral incisions, the diseased synovial membranes scraped away or removed with scissors, and drainage secured, the wound being then dressed antiseptically and the limb maintained at rest upon a splint. I have seen many instances in which this method has been attended with success. It is, however, a proceeding that may seriously tax the general strength, especially in the case of a young child, or of a patient who is already in a condition of exhaustion. It is most suitable for cases in which, though the synovial membrane is extensively diseased, suppuration is not profuse, nor the inflammatory process acute, and in which the patient is above the age of three or four, and not injured in his general condition."[1]

Eugene Vincent writing in Ashurst's Encyclopædia speaks as follows: "Scraping out a joint (arthrosuesis) does not deserve the credit which has been attached to it of late, no matter in what way it is performed. In fact, if it is practiced by passing the sharp curette through the fistulous tracks or through incisions which do not expose the whole of the joint it is insufficient."[2]

As most writers are either silent on the matter or refer to it but cursorily, we must estimate the value of the operation, its comparative advantages and method of performance, from experience, published accounts of cases, and theoretical consideration.

My own experience is limited to three cases—one of these, in which the bones were sutured, is eminently satisfactory, the other two were disastrous, the one boy dying of acute tuberculosis before the wound had soundly healed, the other having to submit to amputation on account of chronic flexion of the limb.

In the *Medical Chronicle* of July, 1885, Wright gives the result of sixteen cases in which he has operated. In his method of operating he lays special stress on clearing away all the diseased synovial membrane, especially at the back of the joint.

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[1] Marsh. Diseases of the Joints, p. 115.

[2] Article in Ashurst's Encyclopædia. Eugene Vincent, M. D.

The limb was afterwards treated by a back splint. No mention of suture of the bones is made. The results he quotes are worthy of note. Of sixteen cases :—

One recovered with a movable and painless joint.

Six recovered with sound and useful joints, though in some of these there was bending.

Two are claimed as partial successes.

Five required secondary amputation or excision.

Two died of intercurrent conditions.

The cases which ended satisfactorily were marked by the following common conditions : Absence of suppuration, superficial bone disease, absence of general tuberculosis. This author arrives at the conclusion that seven of his cases ended with as good a result as excision and without shortening. On close examination of the table given below we cannot quite agree with this statements.

Wright's cases of Arthrectomy. *Med. Chronicle,* July 1885.

1. A moveable joint.
2. No shortening, but the limb tends to become flexed if it is not supported by apparatus.
3. Did not do well, and joint was afterwards excised. Ultimately a firm, straight limb resulted.
4. Erasion, failure, disease too extensive, amputation five days after.
5. A sinus persisted in the knee, and she died of spinal caries and phthisis.
6. Erasion performed in 1882. In 1885 there was a tendency to flexion, if limb was left unsupported.
7. Excision afterwards, and then amputation.
8. Amputation of thigh.
9. Wound did not heal soundly, death from suppuration.
10. Amputation, as wound did not heal.
11. Recovered with slight flexion. Erasion performed in 1884, in 1885 was wearing a Thomas' splint.
12. Sound and well. No shortening.
13. Erasion December, 1884. May, 1885—not quite healed but promises well.
14. Erasion, January, 1884. May, 1885—Not yet healed.

Condition of knee not very good. Some flexion. Neglected at home.

15. Healed entirely. After result not given.

16. Erasion May 25th, 1883. April, 1885—sound and well, but still wearing a splint.

Before taking leave of the consideration of this list it must be remembered that these are among the earlier cases of operation. And there can be little doubt that a similar list of cases by the same operator in the present day would show far better results. Indeed I have had private information from a Metropolitan Hospital surgeon, stating that of late the results of arthrectomy of the knee in his own practice and that of a colleague have been highly satisfactory. Whether this may be due to more careful and intelligent selection of the cases suitable for operation, to methods of performance, or after treatment, I cannot say, though I suspect and am of opinion, that the first and last of these factors are the most powerful agents in the satisfactory result alluded to.

In discussing the merits and disadvantages of the operation of erasion of the knee from an argumentative and theoretical point of view, I shall be as brief as is consistent with clearness of expression. If arthrectomy be limited to the removal of the diseased synovial membranes only, the articular surfaces and ligaments being left intact, it is obvious that the number of cases in which the operation is justifiable or admissible, must be strictly limited to cases of pure synovial disease. Many of these may be treated by milder measures than those of operation. In this strict sense, the number of cases in which erasion is justifiable, are few and far between. But if, as appears to be more commonly the case, diseased cartilage is shaved away from the bone-ends, and suspicious or obviously diseased portions of osseous tissue scooped out with gouge and osteotrite, it is fair to state that the operation is really one of modified excision. It is in this latter sense that I would especially discuss and regard it. But then it will be asked, in what way does this proceeding claim superior advantage to excision? I would reply, that in excision the cut surfaces of bone are larger and the reparative process more severely taxed. The subsequent growth of bone is interfered with, and the operation is often more extensive than the local disease demands. Time and space forbid one writing in detail on the class of cases for which this operation is justifiable. On referring to the remarks of Wright given above, it will be seen that he mentions certain factors, as conducive to success, and I do not know that more reliable guides than these could be found. Prominent, is the question of general tuberculosis and suppuration about the joint, with sinuses and bone disease. When these are present, it is generally held that extensive operations are inadmissible. Yet how diverse are the opinions held on this point may be gathered from the remarks of a recent surgical author. "In cases of advanced tubercular disease, ankylosis of the joint may result if the parts are freely laid open, the granulation tissue broken down, and efficient drainage established, the limb being kept at perfect rest."[1]

But it is certain that great care and discrimination must be exercised before determining upon operation. Speaking generally there are few surgeons who would confidently predict the exact condition of the interior of a joint without opening it. When they have done so they may find local conditions, which may lead them to modify their previously formed ideas of operation. So too it is quite easy, even when a joint is opened, to mistake superficial for deeply seated bone disease, and either to remove a needless amount of osseous tissue, or to leave behind foci of disease, which are sure to lead to future troubles. Mayo Robson, writing in the *Lancet* of January, 16th 1886, on this subject, speaks as follows:—"My friend, Mr. Ward, was excising a knee-joint on account of disease which appeared to be limited to synovial membrane, the articular cartilage and bones being apparently healthy. On examining the excised end of the femur a nodule of tuberculous granulations as large as a pea was found beneath the cartilage. Now, if this joint had been erased instead of excised, the probability is, that the disease would have returned, necessitating excision or amputation." "Arthrectomy is still on its trial, and is not by any means a well established operation."

Having thus briefly glanced at the scope of the operation, the class of cases in which it should be recommended, and the circumspection with which the prudent surgeon should decide upon its adoption, we now naturally have to consider its actual performance. Whether strict Listerism be followed or no, will depend upon the peculiarities of the operator. Strict cleanliness is most essential, and antiseptic fluids, especially the perchloride of mercury lotion, are advantageously employed. Esmarch's bandage in these cases causes troublesome after-oozing. The limb can be rendered moderately exsanguine by elevation and the application of a roller bandage. The stages of operation are as follows.

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[1] Macnamara. Diseases of the Bones, p. 346.

1. *Opening the joint.*—Much discussion has arisen on this point. What incisions give us the best view of the interior of the joint, and yet interfere least with the soft parts around? Putting aside the position of sinuses or other local conditions which might modify the nature of the incisions, we find that the following methods are most generally adopted:—The anterior horse-shoe shaped incision dividing the ligamentum patellæ; Lateral incisions at the same or different levels; Division of the patella both longitudinal and transverse. Doubtless the ingenuity of operators might easily extend this list. Yet if a firm, straight, ankylosed limb is to be aimed at, it seems very immaterial which of these are adopted, provided that the soft parts round the joint are not unduly divided, and free access to the joint easily obtained. The advocates for division of the patella lay great stress on the assertion, that if the anterior ligament be intact, it prevents the slipping back of the tibia so apt to occur after operations on the knee. Now it is the crucial ligaments which form the chief bond of union between the femur and tibia. When they are destroyed by disease, any practical surgeon will know how impotent is the anterior ligament to prevent backward displacement. Again, disease may be left in the patella, or the saw, in passing through a delicate cancellous bone, may originate inflammatory mischief and subsequent caries. That this is no fanciful objection, may be elucidated by the inspection of a specimen in the Museum of St. George's Hospital, prepared by myself when Pathologist to that Institution: it shews a patella removed for caries after 'trans-patellar' excision of the

knee. If the case be limited to disease of the synovial membranes, and a surgeon should be desirous of obtaining movement, lateral incisions, as advocated long ago by Treves, of Margate, will give us free access to the under surface of the patella, and the interior of a joint. I have verified this by operations on the cadaver. But in the majority of cases I feel sure that the anterior incision is the best, and here it may be observed that it is by no means needful to make this so inordinately extensive, as to leave the leg attached to the thigh by only the popliteal vessels and the ham-string tendons. All that is needed is an incision which permits of free inspection and treatment of the whole joint easily. The divided patellar ligament can be sutured with cat-gut, so that the action of the quadriceps in aiding the forward movement be not lost.

2. *The removal of diseased structures.*—No time and pains must be spared in order that this be thoroughly performed. The extent to which ligament and cartilage may be left intact, will vary with the amount of disease present. Yet if there be but so little disease as to permit of the retention of the crucial ligaments, and the cartilages, the case might have done well under other than operative measures? Diseased cartilages must be pared away, spots of carious, or softened bone carefully gouged out. It is hardly needful in this communication to dwell upon the importance of completely eradicating every particle of diseased synovial membrane. Masses of this tissue are apt to escape detection near the posterior part of the joint, or in the plications of the membrane beneath the vasti muscles. The bleeding should be quite arrested by ligature, and the application of hot iodized sponges.

3. *The fixation of the limb and suturing of the bones.*—It may be aptly remarked here, that the greatest essential to union of wounds generally, more especially of osseous tissue, is complete rest with absolute apposition and fixation of the parts implicated. This is especially true of fractures, it is equally binding in the after-treatment of operations, when bony or cartilaginous surfaces have been divided. I believe that many of the unsatisfactory results that are seen after operations on the knee when bony ankylosis is aimed at by the surgeon, are due to neglect or incomplete performance of these

two principles. There is such a vast difference between complete and incomplete rest. There is a striking contrast between complete and partial apposition. The careless and unscientific surgeon places the limb upon an ill-fitting splint, and has it so secured that every start of the muscles, causes the bone-ends to heave under the flaps. A drainage-tube lies between the bone-surfaces. The wound must be frequently dressed, and unless the splint be especially fashioned, the limb has to be moved every other day for the purpose of dressing and cleanliness. This necessitates still further movement of the bone ends. Fungous granulations spring up, profuse discharge ensues, the patient's strength is exhausted, and amputation of the limb is finally resorted to. Occasionally the powers of nature triumph over the imperfect surgical treatment and a good result ensues in spite of it. But such a consummation cannot always occur. Although these remarks apply to excision of the knee, they equally apply to cases of erasion, where bony ankylosis is aimed at. Seeing then that absolute fixation of the joint surfaces is so essential to a good result, we must briefly consider how this is best to be carried out. The splints should be interrupted at the knee, so that the wound may be dressed, and yet the limb not moved. The posterior splint should embrace both thigh and leg, from the groin to the foot. A foot-piece should be fixed upon it, to prevent weakness of the ankle joint from stretching of the ligaments and want of support. This splint should be a little curved, to favor ankylosis in the slightly flexed position. No better plan has ever been adopted for fixing the bone-ends in apposition than that of pegging or wiring them together, as recommended by Baker and others. The ordinary mechanical dexterity which should be possessed by any one who pretends to be an operating surgeon, will enable the operator to do this with such complete success, that the limb may be raised from the table, as soon as the wires are tightened, and no appreciable movement be discerned between bone ends. Thus even if the integrity of the anterior ligament be essential to prevent displacement, which I have already seen reason to doubt, its supposed function is not needed.

The patella had better be removed, if at all diseased : otherwise its surface can be refreshed, and it will ankylose firmly to the front of the femur. The wound may now be united accurately, and if the oozing of blood has been thoroughly checked, there will be no reason that a tube should be employed. When the operation is conducted on these lines, the surgeon has good reason to be surprised if an unfavorable result should ensue. Great care should be taken that the uniting medium, at first fibrous and afterwards osseous, does not yield. Eighteen months may be taken as a fair average period during which artificial support should be employed.

A last and important plea for bony ankylosis in cases of operation in the knee joint may here be dealt with. It is well known that the majority of these operations on the knee are performed upon the children of the poor, or of the so-called working classes, who are unable to afford the means and luxuries so essential in the treatment of chronic joint disease. Years of rest and treatment, changes of air, elaborate splinting, are only at the command of the wealthy. If after operation the child is sent to a poor home, with imperfect union, disaster will surely occur. The surgeon will find to his chagrin, that the limb which perhaps had been exhibited triumphantly before a Medical Society, has now become hopelessly deformed. When he enquires for the elaborate splint, the daily application of which he enjoined, he finds that it has been thrown by, or parted with for some commodity of life, at the nearest pawnbroker's. No stronger argument could be adduced for the importance of wiring the bones, and causing osseous ankylosis before the child is lost sight of.

It is now doubtless obvious to the reader, that the operation of erasion of the knee differs from excision mainly in the more limited operative dealings with the bone ends. In excision a large lamina of bone is removed, in erasion the diseased tissue is gouged away. In the first, growth is apt to be arrested, in the second it should not be interfered with.

In September, 1886, I amputated the limb of a sailor on account of bony ankylosis of the knee in bad position, the result of suppurative arthritis twelve months before. The joint surfaces were united by two buttresses of bone which passed from the trochlear surfaces of the femur to the tibia. These were about the thickness of a man's thumb, and were composed of firm and dense bone. The cartilages had disappeared, and a loose filamentous tissue occupied the interstices of the joint, Had the parts been kept straight, no union could have been firmer or more satisfactory. Thus it would seem that if the opposed surfaces of the femur and tibia are refreshed and united by wire, sufficient osseous substance may be produced to maintain firm union.

It seems that with care in the selection of cases, and especially in the performance of the operation and after treatment, that the proceeding known as erasion of the knee has a promising future before it, and may, in time, be recognized among the more satisfactory operations of conservative surgery.

ON THE ETIOLOGY AND ESSENTIAL NATURE OF SCOLIOSIS.

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THERE have been no thorough and elaborate investigations of the essential nature of scoliosis, which can compare with those of Miculicz into the pathology of genu valgum. But the points of resemblance between true lateral curvature and knock-knee are so strong that one is almost compelled to recognize in the known facts about the latter, the key to the true pathology of the former.

Fig I represents diagrammatically, a transverse, perpendicular section of the body of a vertebra in one of the curves of a scoliotic spine. It is wedge-shaped, with the apex of the wedge towards the concavity of the curve. There has evidently been inequality of development on the two sides of the main bony mass of the vertebra, analogous to the inequality in growth of the two sides of the diaphysis of the femur. (see Fig 2.)